Demand Response Research Center

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## CEC Load Management Workshop

# The Evolution of Demand Response Technologies

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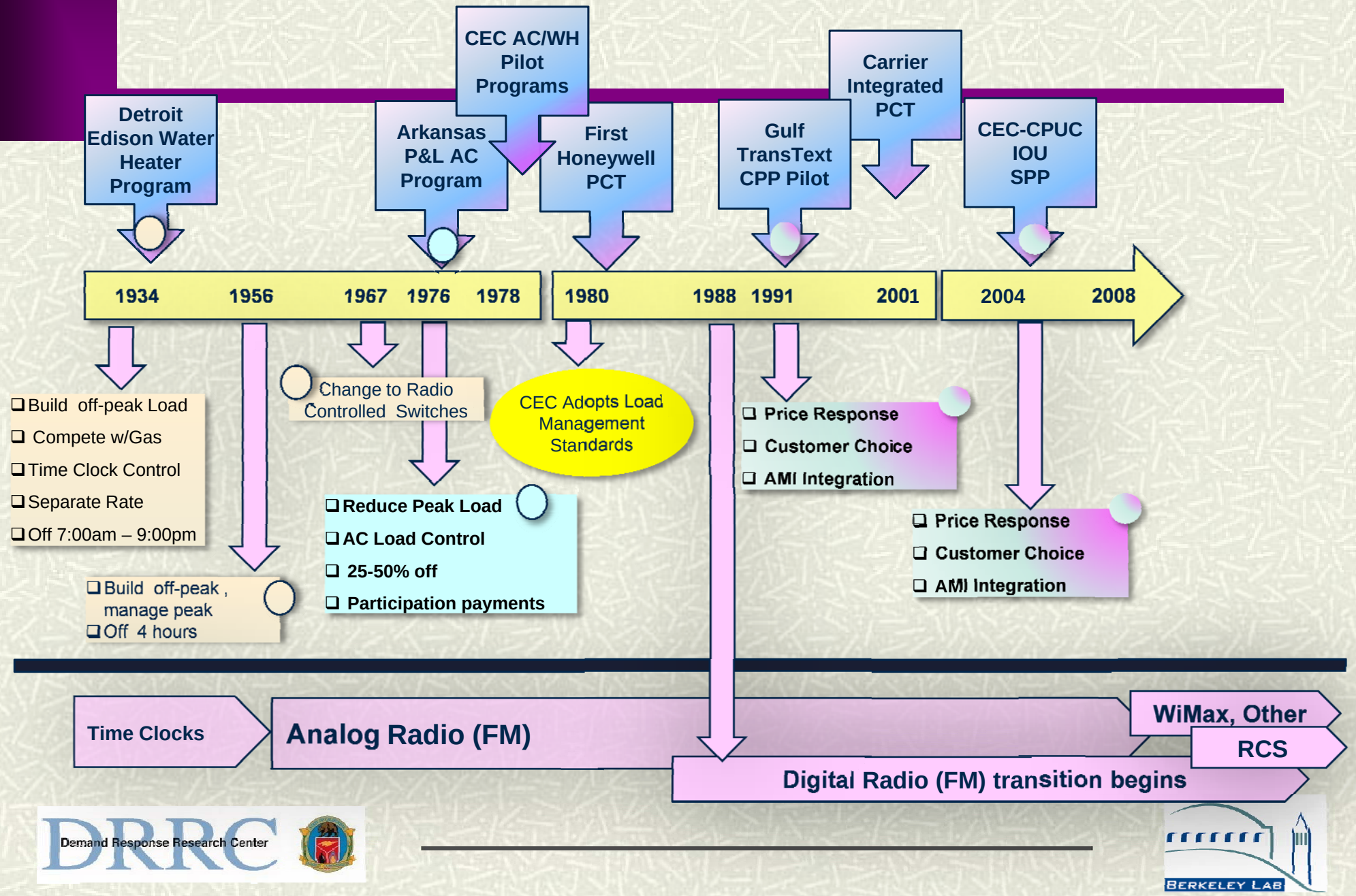
*Levy Associates*

# What do customers want ?

1. Reliable Service
2. Low Cost
3. No Blackouts
4. Customer Choice & Simplicity

# Evolution of DR – Technology and Programs

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# The Vision

## Efficiency and DR Integrated

- Efficiency and demand response fully integrated under a unified default tariff / incentive structure.

1

- Demand Response, like Efficiency a condition of service.
- All customers, all load participates.

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2

- Major appliances come “DR Ready” from the factory.
- All buildings are “DR Enabled” .

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3

- Rates that are easily understood, that create a cause and effect relationship between customer actions and customer costs
- Prices that are actionable under consumer preferences

# Today – DR is A Limited Resource

| | Evaluation Criteria | Direct Control | Price Response |
|---|---|---|---|
| 1 | Customer Choice | ◐ | ● |
| 2 | Economic Response | ○ | ● |
| 3 | Reliability Response | ● | ● |
| 4 | Sustainable | ○ | ● |
| 5 | Cost | ◐ | ● |

● Top rated performance, proven, sustainable effectiveness

◐ Moderate performance, limited but acceptable effectiveness

○ Limited performance, variable, uncertain effectiveness

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# Demand Response - What's Different ?

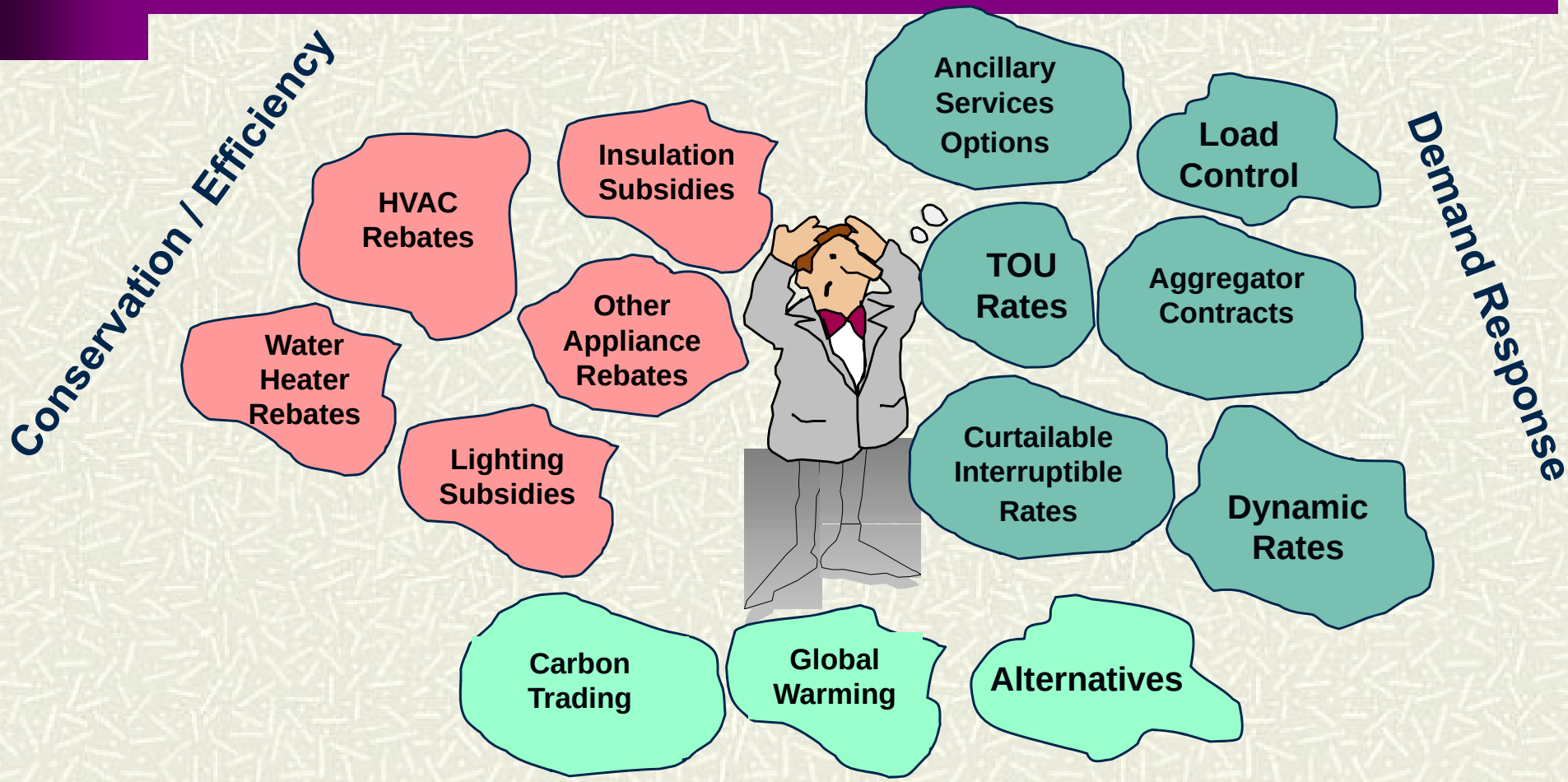
## DR Today

- Separate programs
- Separate incentives
- Pushed into market
- Focused on generation
- Designed for the utility not the customer

## A Better Vision

- DR as a system wide, integrated resource
- Market driven
- Wholesale-Retail integration
- DR for generation and distribution management
- DR for economic & reliability
- Designed for the customer not the utility

# What to Do ?




**Global Warming**

# The Market Model for Load Management

The Benchmark Customer Model Efficiency

| | Utility Model Direct Control | Customer Model Price Response | |
|---|---|---|---|
| Participation | Targeted | All Customers | All Customers |
| Value of DR | Utility Value | Customer Value | Customer Value |
| Ownership | Utility | Customers | Customers |
| Equipment | Few Suppliers | Many Suppliers | Many Suppliers |
| Customization | Little - None | No Limits | No Limits |
| Incentives | Participation | Performance | Purchase & Performance |
| Key Problems | Equity, Sustainability | Rate Design | Performance |

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# How do you get there… and why?

## “ Three Things “

1. Advanced Metering
2. Dynamic Rates
3. Automation

# “Thing #1” - Advanced Metering

| What | Why |
| --- | --- |
| •System wide<br>•Communications<br>•Interval Recording | •Information and customer education<br>•Support Rates – feedback and performance based incentives<br>•System operations |

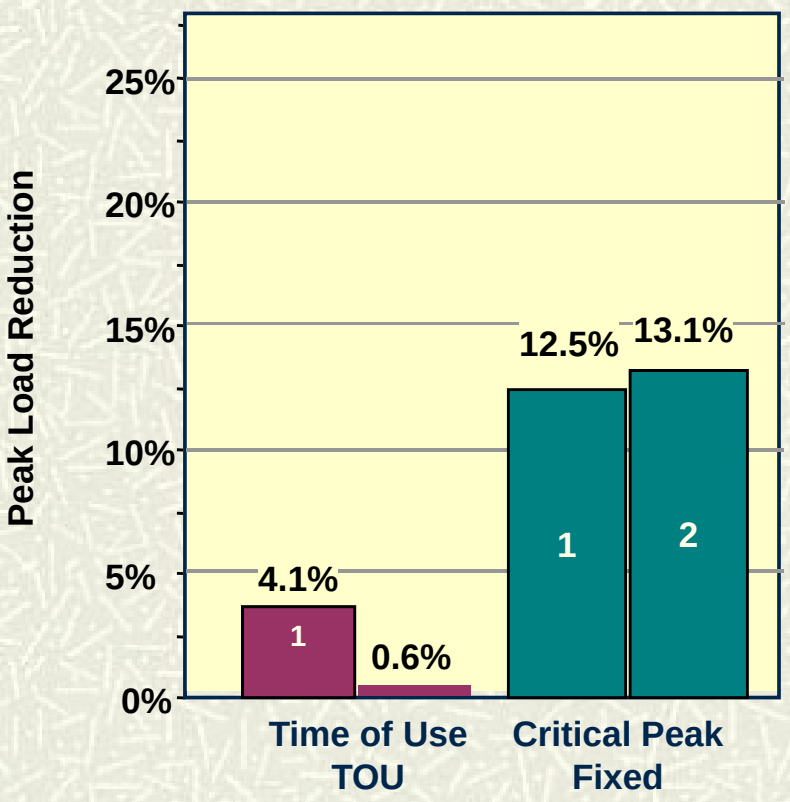
# “Thing #2” – Dynamic Rates

| What | Why |
| --- | --- |
| •Reflect system costs | •Establish a customer value function<br>•Price signals for economic response<br>•Reliability signals for emergency response<br>•Customer Choice |

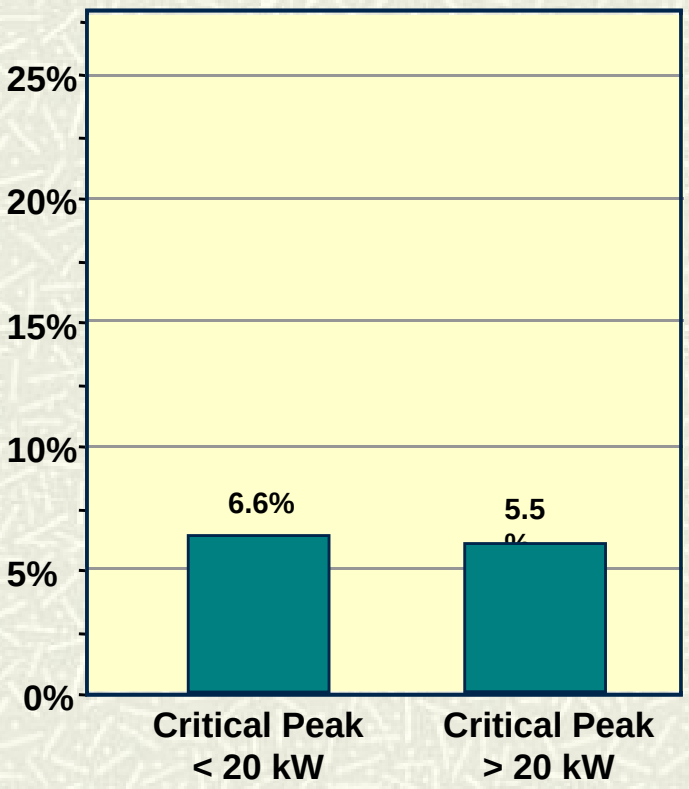
# Customer Response to Price

## Statewide Pricing Pilot

### Residential Critical Peak Impacts (Years 1& 2)




### Small Commercial Critical Peak Impacts

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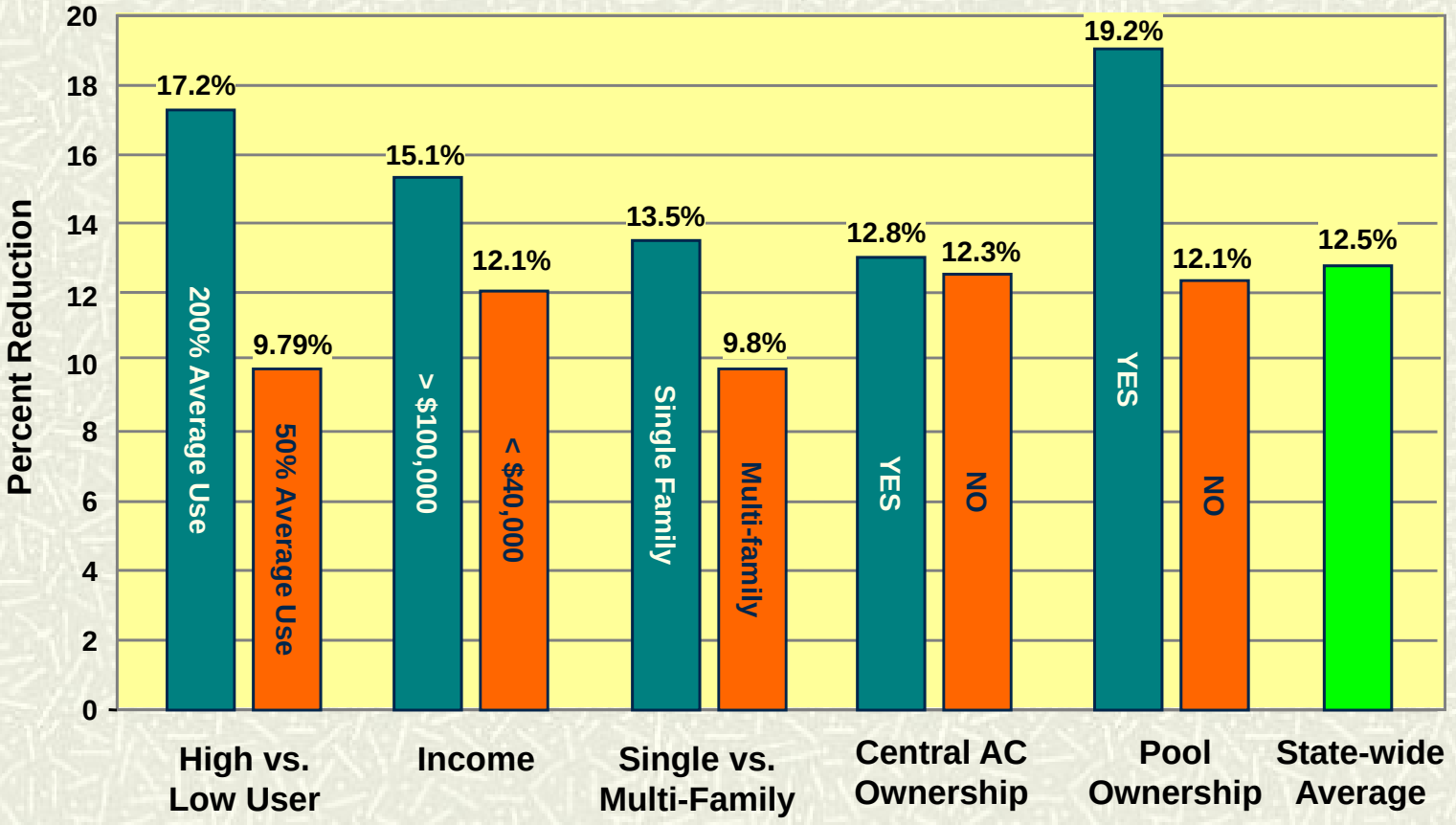
# Customer Response to Price – Residential

## Statewide Pricing Pilot

### All Residential Customers Reduce Peak Load




Source: Statewide Pricing Pilot, Summer 2003 Impact Analysis, CRA, August 9, 2004, Table 5-9, p.90

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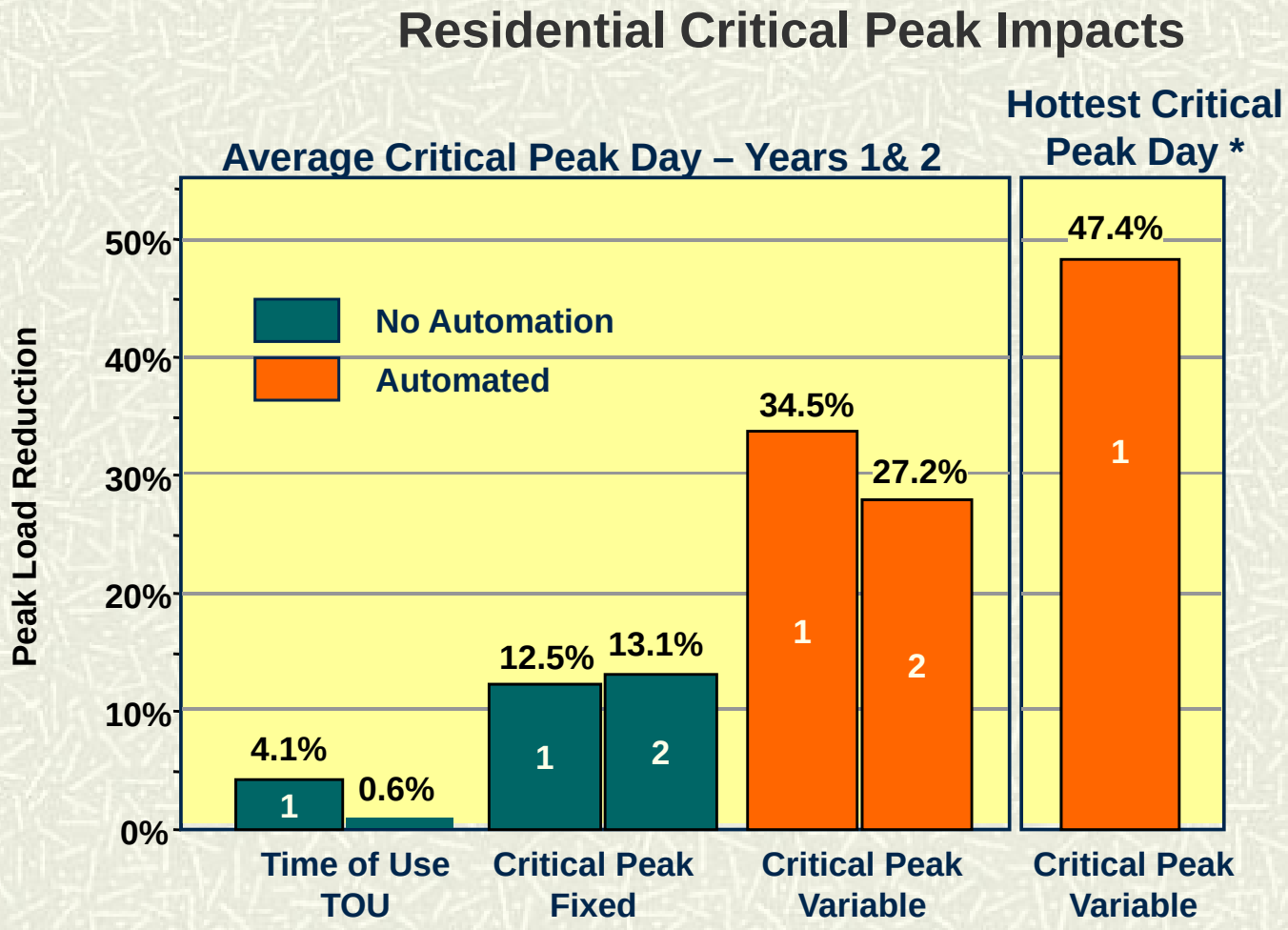
# "Thing #3" – Automation

| What | Why |
| --- | --- |
| • Enable and simplify customer choice<br>• Enable price and reliability response<br>• Integrate with system operations | • Customer acceptance<br>• Expand system potential<br>• System protection |

# Customer Response to Price - Residential

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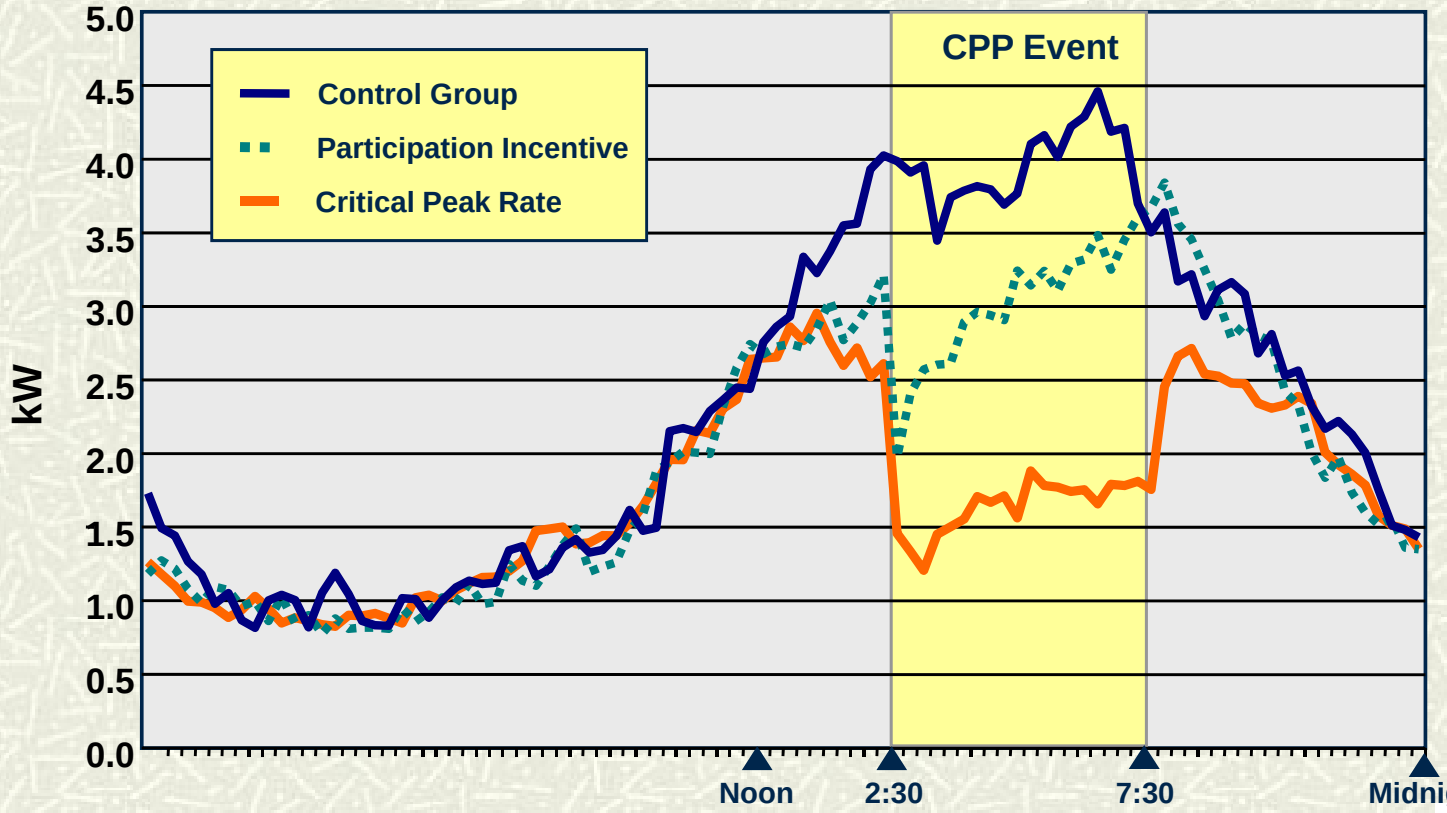
# Customer Response to Price - Residential

## Residential Summer Peak Load
## Controllable Thermostat and Participation Incentive

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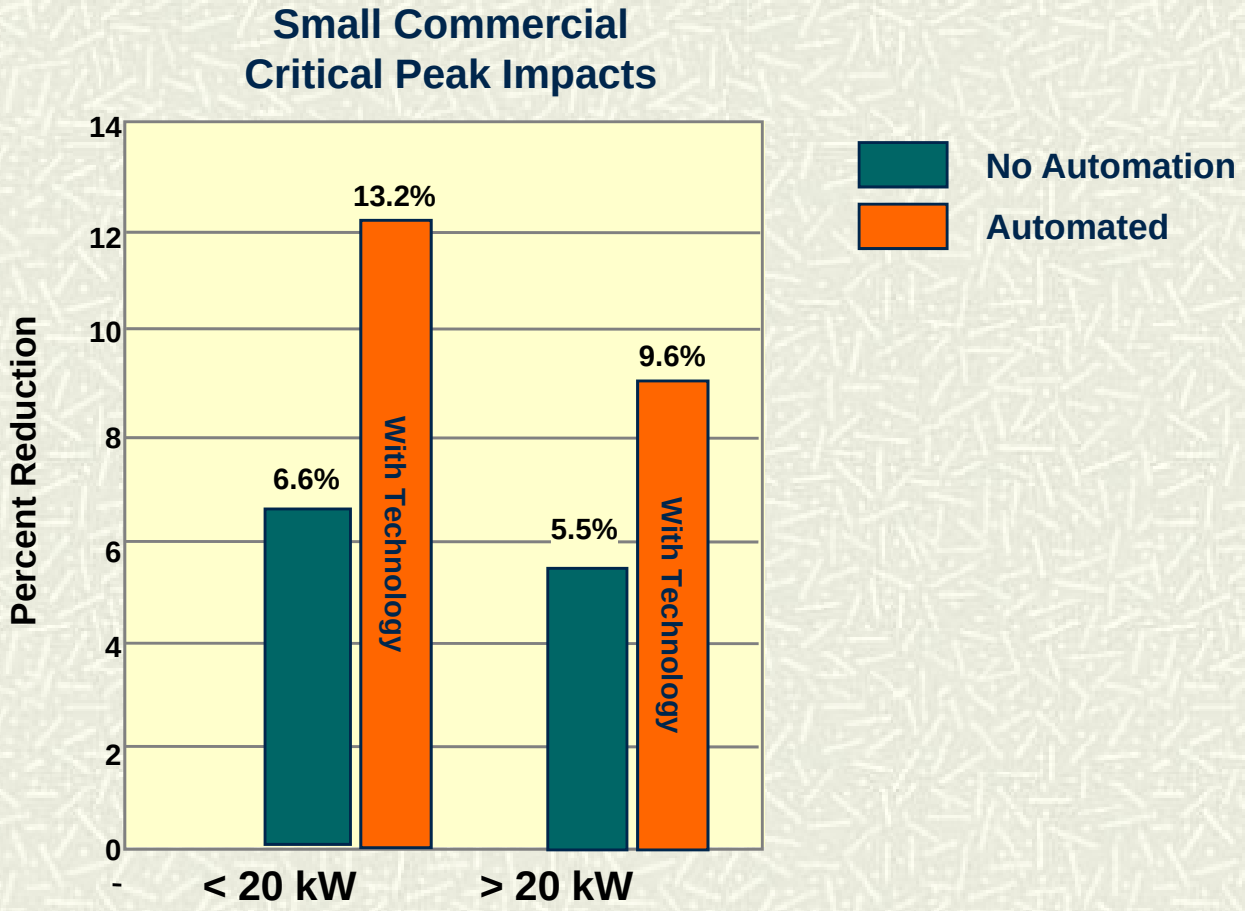
# Customer Response to Price – Small C/I

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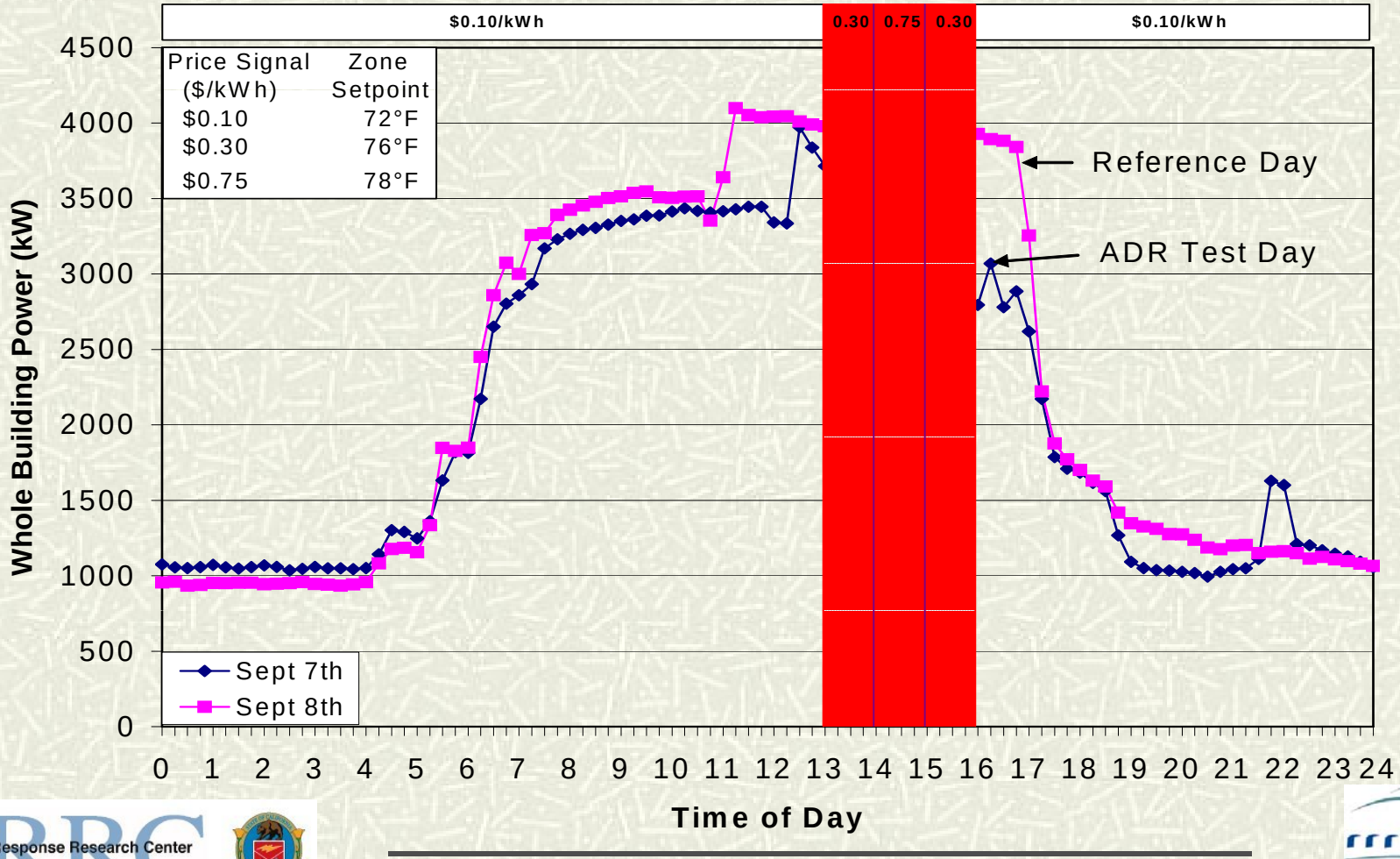
# Customer Response to Price – Large C/I

## AutoDR Results

### Large Commercial Building (Summer 2004, 90 F Day)

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# AutoDR Summary Results - 2007

| CPUC ACR Objectives | 2006 | 2007 Installed | 2007 In-Process | 2007 Total |
|---|---|---|---|---|
| 1. Accelerate Implementation | | | | |
| ▪ Commercial participants | 13 | 125 | 16 | |
| ▪ Industrial participants | 0 | 3 | 8 | 152 |
| ▪ Peak Load Reduction | 1 MW | 18 MW | 7 MW | 25MW |
| 2. Expand AutoDR beyond CPP to other DR options | CPP only | CPP, DBP, CBP | | |
| 3. Expand the role of Technical Providers | none | 8 industry participants | | |
| 4. Improve DR performance (Peak Reduction) | | | | |
| ▪ Commercial | 13% | 23% | 12% | 21% |
| ▪ Industrial | -- | 46% | 66% | 52% |
| ▪ Aggregate All Participants | -- | 31% | 37% | 34% |

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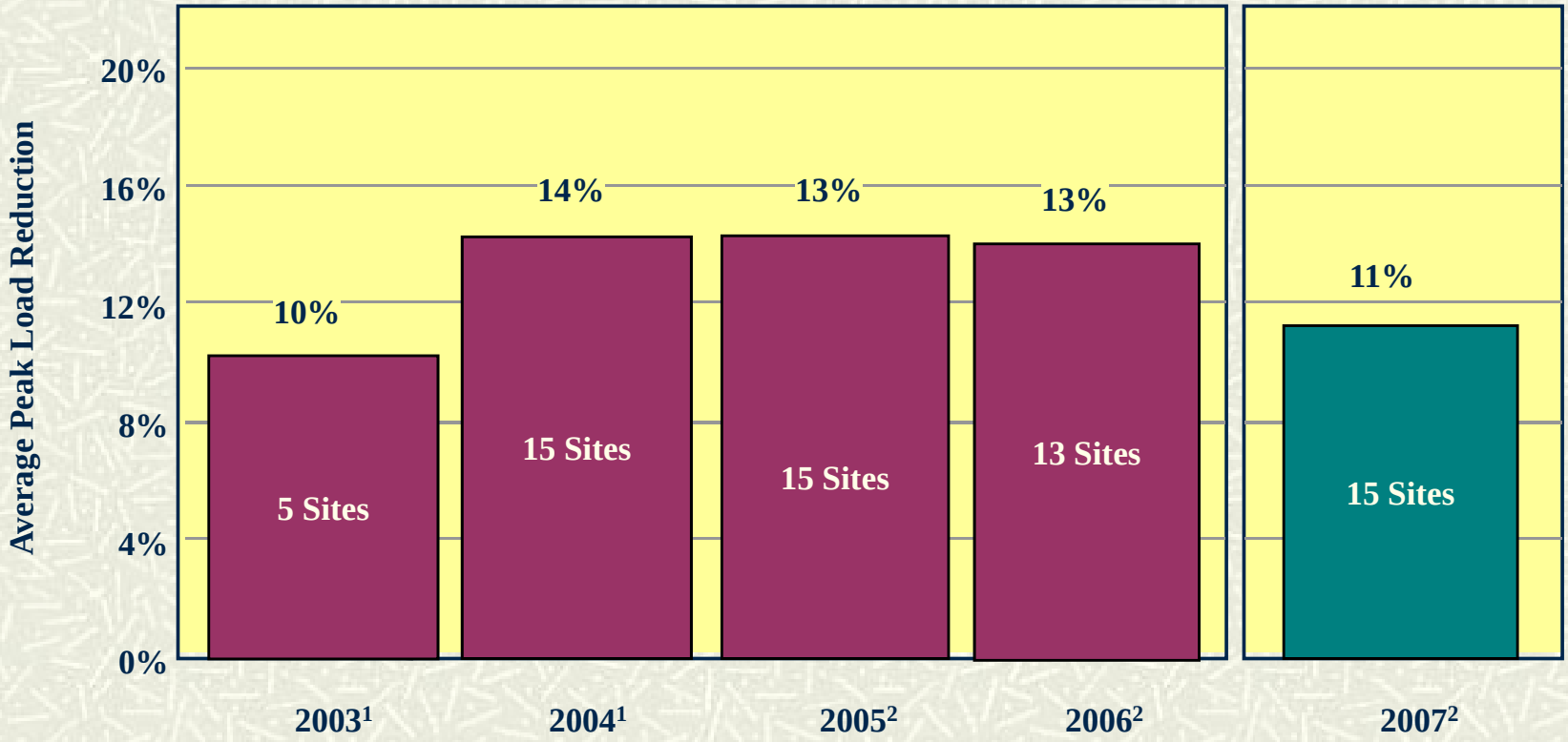
# Continuity / Reliability of Customer Response

## Average Peak Reduction for AutoDR Customers Continuing in 2007




**1** - Customer response to test signals

**2** - Customer response to CPP rate price signals.

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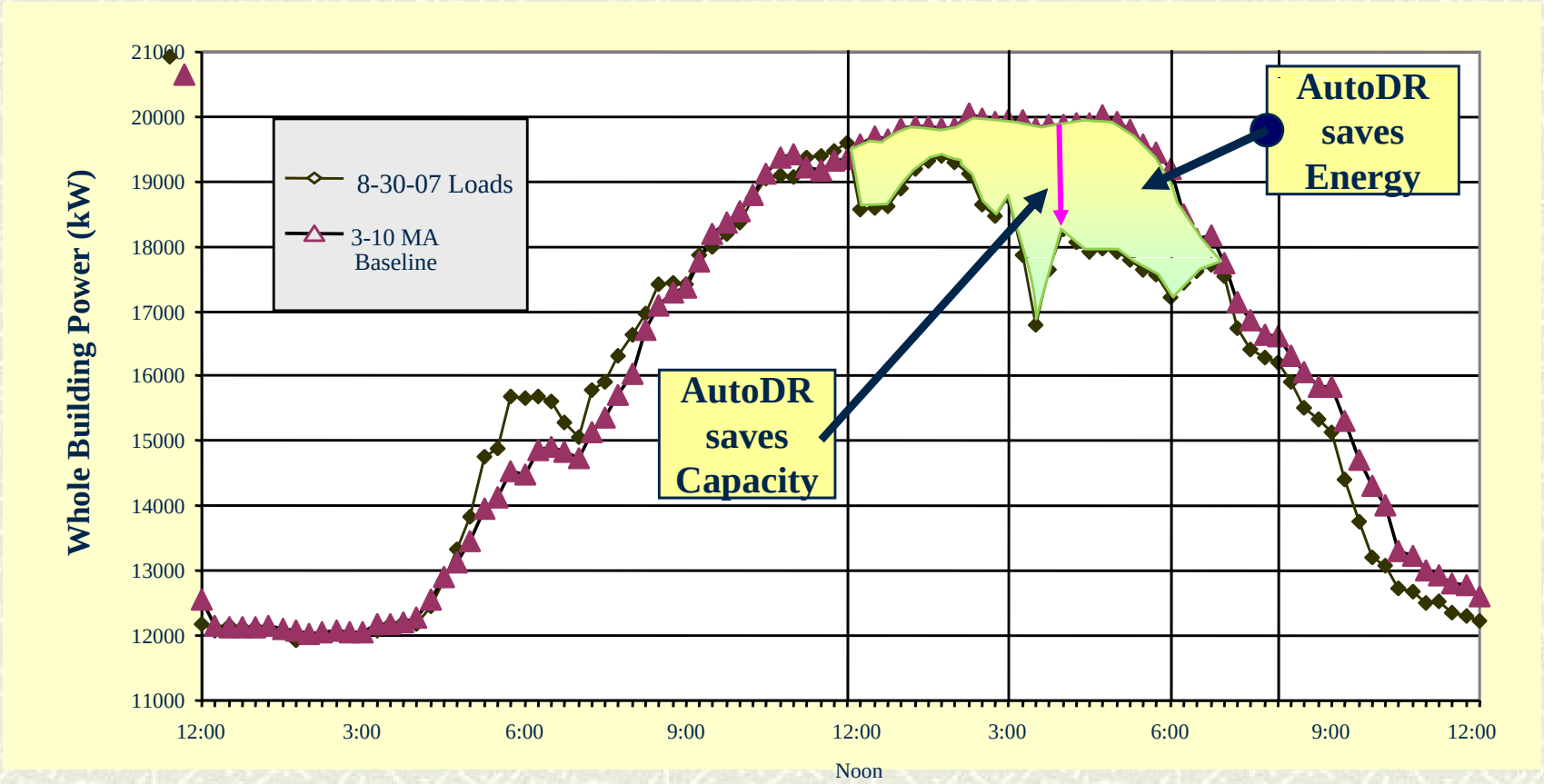
# Auto-DR Load Impact – 8/30 Non-Industrial

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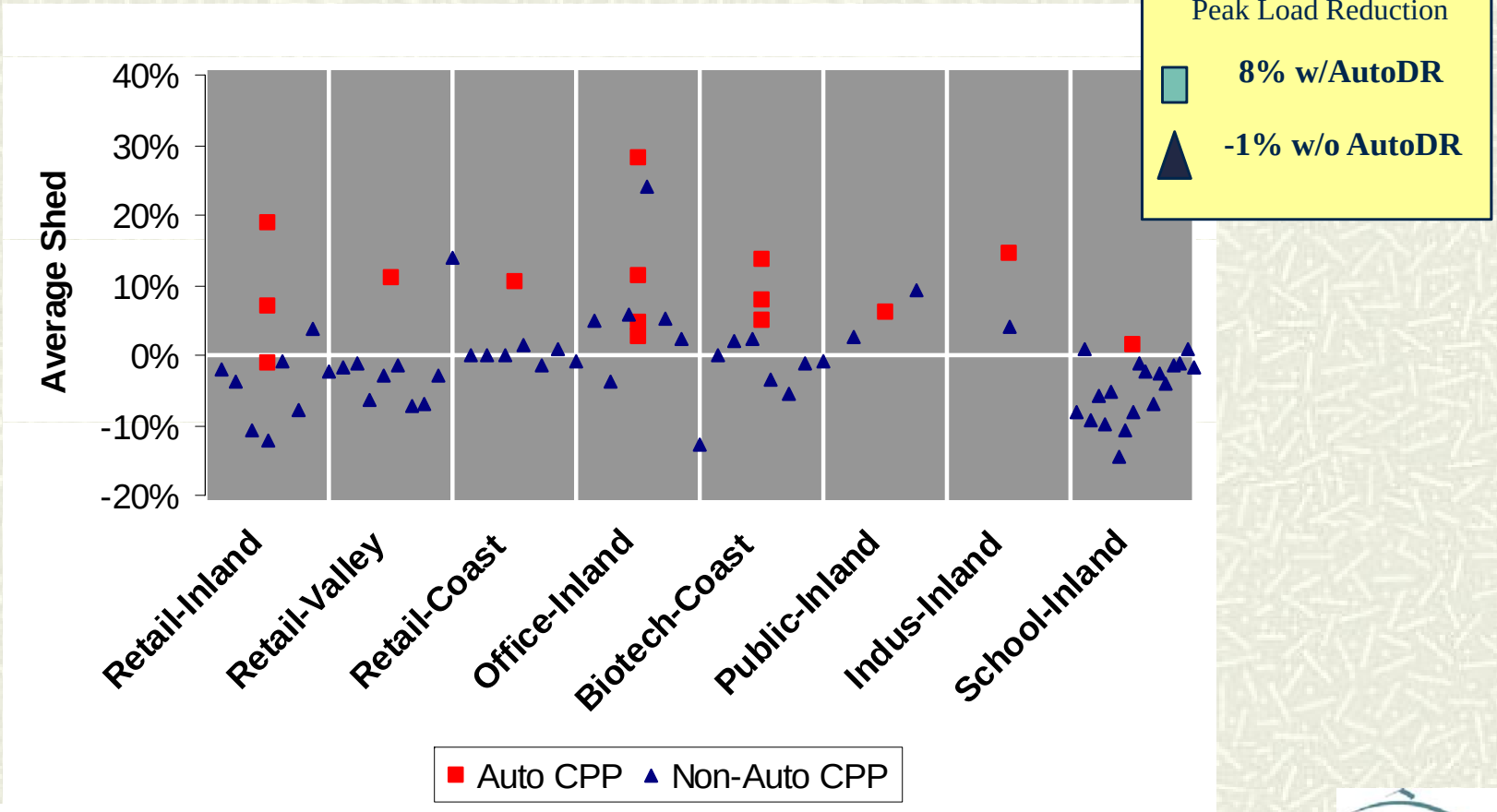
# Auto-Demand Bid Performance

| Date of DBP Event | Number of Participating Sites | Estimated Load Shed (kW) | Actual Load Shed (kW) DBP Baseline | | Actual as Percent of DBP Baseline |
|---|---|---|---|---|---|
| | | | Max 2 Hour | 2pm-6pm Avg | |
| 8/30/07 | 11 | 10,850 | 10,674 | 10,416 | 98% |

# AutoDR Customer CPP Performance

## C/I Customers on CPP
## With and Without AutoDR



# Customer Response to Price – Large C/I

## AutoDR Results

| Company | Avg. kW Reduction (3 hr. shed) | Bldg.Load Percent Reduction | Non-Coincident Max kW Reduction | Events *(2003-4/2005)* | One-time Setup Cost |
|---|---|---|---|---|---|
| ACWD | 52 | 20% | 84 | 4 (0) | $12,824 |
| B of A | 111 | 2% | 227 | 3 (4) | $1,614 |
| Chabot | 18 | 5% | 46 | 3 (1) | $4,510 |
| 50 Douglas | 61 | 21% | 85 | 4 (4) | $2,000 |
| 2530 Arnold | 61 | 16% | 92 | 1 (3) | $2,000 |
| Echelon | 78 | 25% | 110 | 4 (3) | $3,620 |
| Gilead | 71 | 10% | 208 | 4 (1) | $7,500 |
| IKEA | 219 | 12% | 272 | 2 (0) | $5,050 |
| Oracle | 45 | 10% | 65 | 1 (0) | $375 |
| Target | 33 | 10% | 56 | 4 (1) | $3,312 |
| USPS | 202 | 15% | 265 | 0 (2) | $12,000 |
| **Summary** | **951** | **13.4%** | | **49** | **$57.62 / kW** |

# How – New Technology Options

Commercially Available

Programmable Communicating Thermostat

CEC PCT Cost Effectiveness Benchmark

Programmable Communicating Thermostat

CEC PCT First Release Commercially Available

Programmable Communicating Thermostat

$300 $200 $100 $0

Conventional Air Conditioner Control Switch

Commercially Available

PCT Embedded Controls

Projected

**Demand Response Equipment Evolution**

- Switches to thermostats
- Thermostats to embedded controls
- Utility to customer control

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# Contact Information

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